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MADROÑO

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THE MEXICAN ITINERARIES OF T. S. BRANDEGEE

REID MORAN

Townshend Stith Brandegee was a pioneer botanical explorer in Baja California, Mexico, collecting there between 1889 and 1902 (Setchell 1926). Many plants have been named from his collections. He later spent several months on at least two trips in mainland Mexico and there, too, made important collections. Some of the localities where he collected are little known and their names perhaps ephemeral. Moreover, even in one region such as Baja California, the same name may be used for several places. Without a knowledge of Brandegee's routes, therefore, it is sometimes difficult to guess even the general area from which a specimen came; and he left no field notebooks to settle such questions. Nelson (1921) gave a brief account of Brandegee's explorations in Baja California, and Ewan (1942) gave all his itineraries so far as they were then known. But Brandegee's Mexican itineraries can now be given in much greater detail.

New information comes from several sources, which will be named specifically for each trip. Some details are from published accounts of the trips and of the specimens collected by Brandegee and by his various companions. A few further details were found in letters (on file in the Herbarium of the University of California) from Brandegee to his wife in California. But most of the information is from labels on Brandegee's specimens in the Herbarium of the University of California. Data have been collected from about 2000 herbarium specimens and from about 300 references to botanical and zoological specimens.

The dates on Brandegee's specimens are not always right. Nearly five per cent of the labels are clearly inconsistent with the majority, and other errors are probably still unfound. Dates are omitted from the itinerary if they are clearly wrong; but in case of doubt, conflicting dates are sometimes included.

Some specimens apparently have the wrong month but the right year and the right day of the month. Others apparently have the wrong day of the month. About thirty specimens were found to have year dates not fitting into the itineraries given below. These dates are scattered from 1873 to 1903. With the year dates changed, however, most of these specimens do fit into one or another of the itineraries. Thus the fifteen specimens dated September and October 1891 all fit into the itinerary of September and October 1890, and the five dated September and November 1892 all fit into the itinerary of September to November 1893. A few specimens evidently from the 1889 trip are dated 1888, 1890, or 1899.

Except as otherwise noted, every place listed below has been found to be in a position more or less consistent with the rest of the itinerary. Maps consulted include those of Brandegee (1889), Eisen (1895), and Nelson (1921); also the Map of Hispanic America, American Geographical Society; Lower California and the Northwestern States of Mexico, Arey-Jones Company, San Diego, 1930; and charts issued by the United States Hydrographic Office. Other sources are Grinnell (1928) and the Enciclopedia Universal Ilustrada, Hijos de J. Espasa, Barcelona.

The following abbreviations are used for the months: January, Ja; February, F; March, Mr; April, Ap; May, My; June, Je; July, Jl; August, Au; September, S; October, Oc; November, N; and December, D.

Thanks are due to Mrs. Ethel Bailey Higgins for information about Kate Sessions, to Professor Joseph Ewan for various suggestions and information, and to Annetta Carter for help in collecting data from herbarium specimens.

Magdalena Bay to San Quintin, January to May, 1889

Brandegee landed at Magdalena Bay, on Magdalena Island, Baja California, January 11, 1889. After collecting there and on the peninsula, he was joined on the island late in February by Walter E. Bryant and Charles D. Hains of the California Academy of Sciences. After visiting Santa Margarita Island, they began the long northward journey to San Quintín. Brandegee (1889) gave a good account of the trip, with a map of the route, and Bryant (1889) gave a shorter account. Dates are filled in mostly from herbarium labels.

Ensenada, Ja 9; Magdalena Bay or Id., Ja 11–18, 21–23, 25–26, 28; Boca de Soledad, Ja 28; Boca de Santo Domingo, Ja 29; Boca de las Ánimas, Ja 29–30; San Gregorio, F 1–9; Laguna Ramona, F 7; Purísima, F 11–15; Comondú Viejo, F 15; Comondú, F 15–19; Ojo de Agua, F 20; San Jorge, F 22; Magdalena Bay or Id., F 24-26; Santa Margarita Id., Mr 1–7; Magdalena Bay or Id., Mr 11–15; San Jorge, Mr 17–18; Pozo Grande, Mr 18–19; Comondú, Mr 20–30, Ap 2–3; Pozo de los Dolores, Ap 4–5; Purísima Cañon, Ap 5; Laguna Ramona, Ap 5; San Gregorio, Ap 5–6; San Juanico, Ap 7; San Raymundo (San Raimundo), Ap 7; San José de Gracia, Ap 8–9; San Benito or San Benito Cañon, Ap 10–11; Patrocinio, Ap 11; Jesús María, Ap 11; San Joaquín, Ap 12; San Ignacio, Ap 14–17; San Esteban, Ap 17–18; Ascensión[1], Ap 18; San Julio[2], Ap 19–20; San Julio Cañon,

[1] The Arey-Jones map shows a Rancho Asunción about 10 miles north of San Ignacio.

[2] I have not found this place on any map, but Brandegee's account would seem to support the label dates at least in placing it between San Ignacio and San Pablo.

Ap 20; San Pablo, Ap 21–22; Cardón Grande, Ap 23; Campo Alemán or Pozo Alemán, Ap 23–24; Calmallí, Ap 24–26; San Luís, Ap 27–28; San Sebastián, Ap 28–29; el Rancho Viejo, Ap 29–30; Paraíso, My 1–2; San Enrique, My 2; San Regis, My 2–4; Santana[3], My 4–5; San Borja, My 5–6; Llanos de San Julián, My 7; Ubi, Agua Bonita, My 8; Ubi (Yubay), My 8–9; el Llano de Santana, My 9–10; Calamajué, My 10–11; San Francisquito, My 13; Cajón de Santa María, My 14; Santa María, My 14–15; Agua Dulce, My 16; San Fernando, My 18–19; Las Huevitas, My 19–20; El Rosario, My 20–21; Socorro, My 21–22; San Quintín, My 22–24.

Cape Region, January and February, 1890

Brandegee made his first trip to the Cape Region of Baja California in January and February of 1890. Landing at Magdalena Bay, he rode to Todos Santos with a Mexican boy as a guide (Brandegee 1890). Because of the unfavorable season, he collected few plants on this first part of the trip, and as a result the record is very incomplete.

Magdalena Bay, Ja ?; Soledad, Ja 4, 8; Matancita ("Mantecita"), Ja 8; Inocente[4], Ja 8; Juncal, Ja 11, 13; Rancho Salada, Ja 15–16; Rancho Colorado, Ja 16; Guadalupe, Ja 17; Cedro, Ja 18; Rancho Tomate, Ja 18; Todos Santos, Ja 19–20; Sierra de la Laguna, Ja 20–27; Todos Santos, Ja 27–F 1; La Paz, F 1–2, 4–5; Mazatlán, Sinaloa, F 10, 16.

Cape Region, September to November, 1890

In September, October, and early November of 1890, Brandegee, in company with Walter E. Bryant, ornithologist of the California Academy of Sciences, collected in the Cape Region. Bryant (1891) gave a good account of the trip, with an interesting commentary on the lives of the collectors as well as on the habits of the birds.

La Palmilla (La Palmia), Au 31; San José del Cabo, S 1– Oc 10; Miraflores, Oc 13–14; Agua Caliente, Oc 15; Sierra de San Francisquito, Oc 18, 20; Agua Caliente, Oc 21; Santiago, Oc 21; Buena Vista, Oc 23; San Bartolo ("San Bartolomé"), Oc 22–24; San Antonio, Oc 24–25; Triunfo, Oc 26; San Pedro, Oc 29; La Paz, N 1–2, 4–5.

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[3] On Brandegee's map, Santana is shown between San Enrique and San Borja, whereas el Llano de Santana is shown north of Ubi. No specimens were found labeled "Santana," where Brandegee should have been between May 2 and 5. But for el Llano de Santana, where he should have been about May 9 or 10, there are specimens dated May 4, 5, 9, and 10.

[4] Perhaps this should be January 18, for there is an Inocente on the coast about 30 miles above Todos Santos.

Cape Region, March to May, 1892

In March, April, and early May of 1892, Brandegee collected in the Cape Region with Walter E. Bryant and Gustav Eisen, both of the California Academy of Sciences. Published accounts are brief (Brandegee 1892, Eisen 1895). Although Brandegee mentioned spending nearly a month in La Paz, the season was very dry and apparently he made few collections. During May, the party collected in Sonora (Brandegee 1893).

Ensenada, Mr 3; San José del Cabo, Mr 8–17; Cabo San Lucas, Mr 17–18; San José del Cabo, Mr 19–20; La Palma, Mr 21; Miraflores, Mr 21; Santiago[5]; Sierra de San Francisquito, Mr 23; Sierra de la Laguna, Mr 24–26; La Chuparosa, Mr 25; Sierra de San Francisquito, Mr 26–30; Agua Caliente, Mr 31; La Palma, Mr 31; San José del Cabo, Ap 2, 4; Santa Anita, Ap 4; La Paz, Ap 13–14, 20–21, My 8; Guaymas, Sonora, My 12; Hermosillo, Sonora, My 13–15; Las Durasnillas, Sonora, My 17–18; Sierra Matapán, Sonora, My; Hermosillo, Sonora, My 21; San Miguel, Sonora?[6].

Sierra San Pedro Martir, April to June, 1893

Brandegee visited the Sierra San Pedro Mártir in May of 1893 with Alfred W. Anthony, Wilfred W. Anthony, Eugene C. Thurber, and Harry E. and Charlotte M. Wilder (Ewan 1942). Although herbarium labels give some information as to way points, they give few altitudes or localities in the Sierra San Pedro Mártir. Details of the itinerary therefore come mostly from Allen (1893) and Anthony (1893). The altitude of the highest point of the Sierra was estimated at 12500 feet rather than 10126 feet and that of La Grulla at 8200 feet rather than about 7200 feet. Other altitudes should therefore be corrected accordingly.

Tijuana, Ap 17; Carrizo Creek ("22 miles south of Tijuana"), Ap 18–21; Las Palmas, Ap 21; Burro Cañon or Creek, Ap 22–23; Guadalupe Valley[7], Ap 24; Sauzal, Ap 24; Ensenada, Ap 26; Santo Tomás, Ap 27; Guadalupe Valley or Creek[7], Ap 27; Salado Cañon, Ap 27; San Vicente, Ap 28; Colnett, Ap 28; San Telmo, Ap 28–30; Aliso, Ap 30; Valladares, My 3–4; Santa Cruz Creek, My 4; Sierra San Pedro Mártir, first benches, My 5; 7000′, My 6–10; 7500′, My 11; La Grulla, 8200′, My 13–22; Gulf slope, My 23; 8500′, My 25–26; return trip begun, My 27; Valladares Creek, My 29; Valladares, My 30; Aliso, My 30; San Telmo, My 30–31; Colnett, My 31; Cabo Colnett, Je 1; Salado Cañon, Je 1; San Vicente, Je 1; Guadalupe Valley[7], Je 2; San

[5] Brandegee mentioned that on this trip for the first time he ascended by the Santiago trail.

[6] San Miguel was mentioned by Eisen (1895, p. 763); the location is not known.

[7] Note that there are two Guadalupe valleys, one to the north of Ensenada, the other to the south.

Antonio[8], Je 3–4; Ensenada, Je 4; Guadalupe Valley[7], Je 5; Burro Creek, Je 5; Gato Creek or Cañon ("36 miles south of Tijuana"), Je 5–6; Carrizo Creek, Je 6; San Diego, California, Je 7.

Cape Region, September and October, 1893

In September and October of 1893, Brandegee made two trips from San José del Cabo into the mountains of the Cape Region. He was accompanied on the first trip by his wife, Katharine Brandegee, and on both trips by Gustav Eisen, of the California Academy of Sciences. Published accounts are brief (Brandegee 1894, Eisen 1895). The season was dry about San José del Cabo and east of the high mountains, and collections were small; "but west of the mountains the ground was well soaked by frequent showers, and vegetation was luxuriant."

San José del Cabo, S 1–6; San Felipe, S 9; Corral Piedra, S 9–10; San Lázaro or Sierra San Lázaro, S 10–11; El Taste, S 11–16; Saltillo, S 15–18; near Sierra San Lázaro, S 16–17; San Jacinto, S 18; Todos Santos, S 18; Pescadero, S 20–21, 23; coast south of Pescadero, S 23; near Sierra San Lázaro, S 25; San José del Cabo, S 27–28; Mazatlán, Sinaloa, Oc 8[9]; Santa Anita, Oc 11; Cañón Hondo, Oc 12[10]; Miraflores, Oc 12–13; San Bernardo Cañon, Oc 13–14; Saucito ("near Sierra San Francisquito"), Oc 14–15; San Francisquito, Oc 16; La Chuparosa, Oc 16–18, 21; Sierra de la Laguna, Oc 19–21; Cañón Hondo or Arroyo Hondo, Oc 21–22; Todos Santos, Oc 22; Pescadero, Oc 23; San Jacinto, Oc 23–24; La Mesa[11], Oc 24–25; San José del Cabo, Oc 27; Mazatlán, Sinaloa, N 2–3; Guaymas, Sonora, N 7–8.

Voyage of the Wahlberg, March and April, 1897

In March and April of 1897 on A. W. Anthony's schooner *Wahlberg*, Brandegee visited the islands off the west coast of Baja California. Others of the crew were Anthony, Henry B.

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[8] According to Brandegee (1893b, p. 207), this San Antonio is between Tijuana and Ensenada; and the Arey-Jones map shows a San Antonio about 10 miles north of Ensenada. On the type sheet of *Madia valida*, however, Brandegee is quoted as later saying that this San Antonio is well south of Ensenada. San Antonio del Mar is some 65 miles to the south—a long day's journey—and furthermore is south of San Vicente, where he apparently collected on June 1. Though two places called San Antonio are shown *east* of Ensenada, I find no other on the probable route.

[9] Though no visit to the mainland was mentioned by either Brandegee or Eisen, this date is supported by 14 herbarium labels.

[10] According to one label of another date, Cañón Hondo is in the Sierra de la Laguna. Whether it is on the east side of the range, and how far down it bears this name, I do not know. Perhaps this date is wrong.

[11] I have not found this name on any map, but it falls in about the same place in the itineraries of 1893 and 1902.

Kaeding, Richard C. McGregor, and Alfred L. Stockton. Though the *Wahlberg* went on to the Revilla Gigedos, Brandegee went home by steamer from San José del Cabo, stopping at Magdalena Bay and probably at Ensenada. Brandegee (1900) gave an interesting general account of his trip; details have been filled in partly from herbarium labels and partly from a catalog of Anthony's (ms).

Ensenada, Mr 5–6; Todos Santos Is., Mr 6–7, 9–10; San Martín Id., Mr 12–13; San Gerónimo Id., Mr 15, 17–18; Guadalupe Id., Mr 20–26; Sparmanns Cañon, Guadalupe Id., Mr 26; San Benito Is., Mr 27–31; Cedros Id., Ap 1–7; Natividad Id., Ap 9–10; San Bartolomé Bay, Ap 12–14; San Roque Id., Ap 16; Asunción Id. ("Ascensión Id"), Ap 17; coast near Asunción Id., Ap 17; Abreojos Pt., Ap 18–19; San José del Cabo, Ap 22–30, My 2, 7–8; Magdalena Bay, My ?. According to a letter from San José del Cabo dated May 2, 1897, Brandegee expected to leave by steamer for Ensenada about May 15.

Cape Region, September to November, 1899

In September and October of 1899, Brandegee made a seventeen-day trip from San José del Cabo into the northern mountains of the Cape Region. Aside from herbarium labels, the only information about the trip comes from letters written October 12 and 21 from San José del Cabo. He wrote that there had been little rain and that the vegetation seemed to be late.

San José del Cabo, S 15; La Palma, S 25; Miraflores, S 26; Agua Caliente, S 27; Vinoramas ("Binorama"), S 28; San Francisquito or Sierra San Francisquito, S 27, 29, Oc 1; La Chuparosa, Oc 2; Sierra de la Laguna, Oc 2–4; Todos Santos, Oc 4; San Vicente[12], Oc 8; San Pedro, Oc 9; Pescadero, Oc 9; Mesa Verde, Oc 10; San José del Cabo, Oc 10, 12, 16–17, 19, 21, 26, N 1, 3; Miraflores, Oc 14, 27; La Paz N 9.

Coronado Islands, April, 1902

One specimen was seen from the Coronado Islands, dated April 27, 1902. No other Brandegee specimens from the Coronado Islands were found among the species known to occur there.

Cape Region, September to November, 1902

In October and November of 1902, Brandegee made his last trip to the Cape Region and "explored many localities not visited . . . during previous trips." Miss Kate Sessions went with him by ship to San José del Cabo and by burro into the mountains, starting back to San Diego about October 22 while he stayed on. Brandegee (1903) mentioned the trip but said nothing of the route. He wrote that because of the pre-

[12] If this is the San Vicente just east of San José del Cabo, then the date must be wrong.

vious drought not all the bushes were in bloom, but that the country was never so green, with the annuals more luxuriant than he had ever seen them before. Yet specimens are few, and often they are dated with only the month and the year.

According to Bailey (1937), Brandegee and Miss Sessions collected in the Cape Region in October of 1900. And according to Cockerell (1943), Brandegee and Miss Sessions once "went on mules all the way down Baja California to the Cape [and] returned by sea." I have seen no specimens to support a visit to the Cape Region in 1900 or a southward overland trip at any time. Probably both Bailey and Cockerell referred to the trip of 1902.

San José del Cabo, Oc 13, 16; Santa Anita, Oc 15 or N 15?; Cajoncito[13], Oc 18; Sierra San Lázaro, Oc 18; San José del Cabo, Oc 21?, 24–26; San Felipe, Oc 30; La Mesa[11], Oc 31; Sierra el Taste, N 1; west side of Cape Region mountains, N 4–5; west coast of Cape Region, N 8; Miraflores, N 14?; San José del Cabo, N 25; Sierra de la Trinidad, N; Cabo San Lucas, N; San Felipe, N; La Palma, N; Pescadero, N; Magdalena Bay N; Ensenada, D.

Sinaloa, August to November, 1904

From August to November of 1904, Brandegee made a large collection in the vicinity of Culiacán, Sinaloa. He landed at Altata in August and during most of the period made his headquarters at Culiacán; but for about two weeks he stayed at a ranch near Cofradía, fifteen miles to the east, at the foot of Cerro Colorado. Brandegee (1905) gave a short account, and several letters add some details.

Altata, Au; Culiacán, Au 18–22, 24–25, 30; Altata, S 2; Culiacán, S 2, 6–8; Yerba Buena ("a house 10 miles from Altata"), S 10; Culiacán, S 11–14, 17, 19–20; Yervacito[14], S 20–21, 26; Culiacán, S 22–24, 30, Oc 1, 5, 8–10; Yerba Buena, Oc 10; Culiacán, Oc 11–12, 18–20; Cofradía, Oc 20–29, 31, N 3, 5; Cerro Colorado, Oc 28, N 1, 3, 5; Imala, N 8; Culiacán, N 10–11, 14, 16; Altata, N 20.

Southern Mexico, May to July, 1908

For many years Brandegee identified and distributed the Mexican collections of his friend Carl A. Purpus. From May to July of 1908 he collected with Purpus in the states of Puebla and Oaxaca. But although he helped with the collecting, his name does not appear on the labels of the joint collections. In fact, in his report on the Purpus collections, Brandegee (1909) did not even mention that he had accompanied Purpus on the trip. Since Purpus did not give days of the month, the

[13] If this is the Cajoncito south of Pescadero, then probably the date is wrong.

[14] I have not found this name on any map, but there is no particular reason to question either the name or the dates.

route cannot be traced by means of herbarium labels. Moreover, the two were not together during the entire period, for Brandegee did not make some of the more difficult trips. The little information given below is mostly from a series of interesting letters.

Tehuacán, Puebla, My 9; El Riego ("against the hills 3–4 miles from Tehuacán"), My 9–11; Sierra Paxtle ("the high Cerro de Paxtle can be seen from the city of Tehuacán"), My 13; San Luis Tultitlanapa[15], Puebla, My 14; Las Naranjas, Oaxaca, My 28; Río Santa Lucía[16], My 30; San Luís Tultitlanapa, Je 8–9, 25, Jl 2, 13.

Bailey Hortorium,
Ithaca, New York

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[15] Five of Brandegee's letters were written from San Luís. In his account, he said that most of the plants were collected near San Luís Tultitlanapa, south of Tehuacán near the boundary of Oaxaca. Though he said that San Luís had 300 inhabitants, I do not find San Luís Tultitlanapa on any map. However, he also said that Caltepéc was two miles away; and about two miles east of Caltepéc there is an San Luís Atototitlán. Perhaps this is the same place.

[16] Río Santa Lucía is said to separate the states of Puebla and Oaxaca. Since it is close to Las Naranjas, this may be the river shown on some maps as Río Hondo.

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INDEX TO LOCALITIES

All localities are in Baja California unless otherwise indicated. For 1890, and again for 1893, the first trip of the year is indicated by the yeardate with an "A", the second trip by the yeardate with a "B".

THE STATUS OF LOPHOTOCARPUS IN WESTERN NORTH AMERICA

Herbert L. Mason

In his treatment of the family Alismaceae, Kunth (1841) divided *Sagittaria* into three sections; the last of these was followed by the word, *Lophiocarpus*, in parentheses, which suggests that this name was intended in some subgeneric status. No names were assigned to the other two sections. In *Lophiocarpus* were included *S. cordifolia* Roxb. from Calcutta, *S. guyanensis* HBK. from near Angustura in Guiana, and *S. echinocarpa* Mast. from Pará, Brazil.

Miquel (1871, p. 50) used the name *Lophiocarpus* in a generic sense and transferred *S. cordifolia* Roxb. to it.

In his monographic treatment of the family Alismaceae, Micheli (1881) also adopted the name *Lophiocarpus*, referring it back directly to Kunth rather than to Miquel through *L. cordifolia*. In this work Micheli transferred the North American *Sagittaria calycina* Engelm. to the genus *Lophiocarpus*.

Lophiocarpus was recognized by Th. Durand (1888) in the body of his text but he credited it to Micheli. Apparently before the work was complete he discovered the earlier *Lophiocarpus* Turcz. of the Chenopodiaceae and in the addenda proposed the name *Michelia* as a substitute. Before the index was prepared, however, Durand discovered that *Michelia* Th. Dur. was antedated by *Michelia* L. of Magnoliaceae. Therefore, in the index of his work, under the italicized entry *Lophiocarpus*, occurs the word *Lophotocarpus* Th. Dur. in ordinary type and in parentheses. This, I believe, is valid publication of the epithet *Lophotocarpus* even though Durand erroneously credited the basic synonym *Lophiocarpus* to Micheli rather than to (Kunth) Miquel. Through the reference to Micheli, however, we are enabled to get back to the original use of *Lophiocarpus* by Kunth, and that is all that is really important. Buchenau (1889) published the account of Alismaceae in Engler and Prantl, Die Naturlichen Pflanzenfamilien, recognizing *Lophiocarpus* Miq. with serious misgivings as follows:—"Von *Sagittaria* kaum genugend verschieden."

In their treatment of the Alismaceae, in a "List of the Pteridophyta and Spermatophyta growing without cultivation in northeastern North America," Morong and Smith (1894) made the nomenclatural transfer of *Sagittaria calycina* Engelm. to *Lophotocarpus*. In so doing he misspelled one of the synonyms, thus erroneously crediting *Lophianthus*, a name that had not hitherto been published, to Micheli.

Smith, in a later work (1895, p. 28) treating of the Alismaceae in North America, discusses his reasons for this transfer. He stated his case as follows, "I have followed Buchenau and Micheli in separating the species of *Lophotocarpus* from

Sagittaria. Lophotocarpus is annual (at least our species), the flowers are perfect or staminate, and the stamens are hypogynous. *Sagittaria* is perennial, monoecious or dioecious with the fertile flowers never perfect, and the stamens are born above the receptacle." At the time the transfer was made, Smith construed the genus in the United States as involving a single species, *Lophotocarpus calycinus* (Engelm.) Smith, without varieties or subspecies, and gave Micheli as authority for another species, *L. guyanensis* (HBK.) Mich. from "Mexico, etc." In a still later treatment Smith (1899) recognized seven species within what he previously had regarded as *L. calycinus*. Of these, two were described as new: *L. californicus* and *L. spatulatus*.

With respect to the separation of *Lophotocarpus* from *Sagittaria* there are three points that we wish to raise. First, the differences suggested by Smith are apparently not of sufficient character to preclude confusion in their application by students. This is reflected in the haphazard identifications evident on the material in any herbarium. Secondly, the characters utilized are either not conclusive or they are misleading by virtue of the way they are expressed. These characters will be discussed momentarily. Thirdly, since our classification system is designed to express the natural relationship among plants, the morphological characters of *Lophotocarpus* that suggest its relationship to *Sagittaria* are such that, in the opinion of the writer, the genus cannot be removed from *Sagittaria* without taking with it other species not included by Smith. Such a disposition would result in completely unnatural genera. We shall now discuss the above points.

The first point is sufficiently clear as to warrant no further amplification. However, additional reasons for it will be apparent from the discussion of our second and third points. In segregating the two genera, Smith states that the stamens are "hypogynous" in *Lophotocarpus* while in *Sagittaria* they are "born above the receptacle." It is difficult to understand just what the author thought he saw in this supposed contrast. It is possible that this is only a direct translation of the phraseology of the key expressed in Latin by Micheli. In material that we have studied, the stamens are hypogynous in both *Lophotocarpus* and *Sagittaria*. Another character utilized by Smith is the occurrence of perfect and staminate flowers in *Lophotocarpus* and of pistillate and staminate flowers in *Sagit-*

Explanation of Figures 1–9.

Figs. 1–9. *Sagittaria Sanfordii* Greene: *1*, stamen, showing inflated hairs on filament, × 7; *2*, inflorescence, showing staminate flowers and fruit, × ½; *3*, mature fruit, × 7; *4*, typical mature plant showing runner and perennating corm, × 1/10; *5-8*, variation in leaf blades, × ⅓; *9*, sprouting corm, × ⅔. Figs. 1-4, 6, 9, based on *Mason & Grant, 13001;* fig. 5, based on *Mason & Smith 8320;* figs. 7, 8, based on *Nobs & Smith 169*. All from fresh material.

FIGS. 1–9. *Sagittaria Sanfordii* Greene.

taria, but frequent exceptions to such segregation of flower type seriously weaken the significance of such a character as being representative of a clearly fixed genetic difference such as should characterize genera. In some populations of *Sagittaria latifolia* as well as of *S. Greggii,* individuals are frequently encountered having either perfect and pistillate flowers, or the lower pistillate, the middle perfect, and the upper staminate. Likewise, individual specimens of *Lophotocarpus* with pistillate flowers have been observed. Further, Smith contrasts the "annual"' habit of *Lophotocarpus* with the "perennial" habit of *Sagittaria.* It would have been better if the character used emphasized the development of perennating corms at the ends of the rhizomes in *Sagittaria* since in *Lophotocarpus* no such corms are produced. This would at least have placed the problem on a morphological basis and would thus eliminate a very obvious source of confusion owing to the fact that several species of *Sagittaria* are perennial or annual depending on the circumstances under which they grow. For example, *S. Greggii,* like most of the species, blooms the first year from seed. In the rice fields where this species is common, the water is drained off before the corms develop; so the plants reproduce only by seed. In some vernal pools this occurs naturally. This character raises an interesting technical point regarding plants that produce perennating structures other than the plant body upon which these structures are produced. Since each season's plant dies at the end of the season, are such plants any more perennial by virtue of asexual offsets than are plants that produce seed before they die? In each case the parent as an objective unit dies leaving one to several new, independent objective units each of which develops into a new plant. Obviously, this problem has many philosophical ramifications which are outside the scope of this paper.

When we compare *Lophotocarpus californicus* with the species of *Sagittaria,* our attention is immediately focused upon certain characters obviously in common with *Sagittaria Sanfordii* Greene. In both of these species the fruit is born on a recurved pedicel (figs. 2, 14, 18). In both, the filaments of the anthers are clothed with scaly inflated hairs (figs. 1, 15) which collapse and fall off when the specimen is dried. In both, some of the leaf blades are elliptic (figs. 5, 8, 11-13). In *S. Sanfordii* these represent the most highly developed leaves, the others

EXPLANATION OF FIGURES 10–19.

FIGS. 10–19. *Sagittaria calycina* Engelm.: *10–13,* developmental stages from seedling to mature plant, × ⅓; *14,* mature plant, × 1/5; *15,* stamen showing inflated hairs on filament, × 7; *16,* pistillate flowers in young inflorescence, × ½; *17,* young inflorescence showing subtending bracts, × ½; *18,* inflorescence showing staminate flowers at apex and fruits below, × ½; mature fruits, × 5. Figs. 10–13, based on *Mason & Smith 8217;* figs. 14–-19, based on *Mason & Smith 8322.* All from fresh material.

FIGS. 10–19. *Sagittaria calycina* Engelm.

being bladeless. In *Lophotocarpus californicus* they represent the juvenile stages in the ontogenetic development of the individual plant. Both species begin flowering while still producing juvenile leaves, and usually each plant continues to produce inflorescences throughout the summer and early fall. The remainder of our Californian species of *Sagittaria* rarely produce more than two inflorescences. We are to weigh these characters against the so-called annual and perennial habit and the distribution of the sexes in the inflorescence, a condition which is not too well established in any of the related species. Obviously *Sagittaria Sanfordii* is more closely related to *Lophotocarpus californicus* than to any other species of *Sagittaria*. To place it in the genus *Lophotocarpus* would completely destroy the naturalness of *Lophotocarpus* in contrast to *Sagittaria*. Yet the concomitance of characters demands that however we may treat *Lophotocarpus californicus* generically, so must we treat *Sagittaria Sanfordii*. To place them together in *Lophotocarpus* destroys completely the character basis of the original reference of *S. calycina* to *Lophotocarpus* by Smith. Additional character differentiae do not warrant a rediagnosis of *Lophotocarpus* to include *S. Sanfordii*.

We therefore conclude that at least so far as *Sagittaria calycina* Engelm. and its segregates are concerned the objectives of taxonomy are best served by retaining them in *Sagittaria*.

To conclude these remarks we need only to clarify Smith's concept of *Lophotocarpus californicus* as distinct from *L. calycinus*. Our field experience in the western states makes it amply clear that there are no significant definable differences between what Smith set up as *L. californicus* and what he retained as *L. calycinus*. To serve as his nomenclatural type of *Lophotocarpus californicus*, Smith selected from the herbarium a slender individual such as may be found in any dense stand of these plants. The inflation of the dorsal wing of the achene is so variable in the achenes of any well-developed fruiting head that it lacks taxonomic significance. Both the inflated type of achene ascribed to *L. californicus* and the flat type of *L. calycinus* are to be found on any well developed fruiting head. The range of variation in the stature of the plant and the leaf pattern is enormous and gives evidence of representing stages in the ontogenetic development of the individual as well as ecological modifications. The fact that the plants begin blooming before they attain full maturity and continue to bloom throughout the season contributes to the wide variation in stature evident in the specimens preserved in herbaria.

Jepson (1912, pp. 79-80) recognized *Lophotocarpus calycinus* and rejected *L. californicus* Smith. He also listed as a synonym, *L. fluitans* Smith as represented by the illustration in Smith's paper. All of these epithets represent individuals

that are clearly within the range of variation evident in any large stand of *L. calycinus* in California.

The following synonymy represents our opinion as to the relationships of *Sagittaria calycina:*

Sagittaria calycina Engelm. in part. in Torr. Mex. Bound. Survey. II:212. 1859.

Lophiocarpus calycinus Micheli in DC. Monog. Phaner. 3: 61. 1881.

Lophotocarpus calycinus Smith, Rep. Mo. Bot. Gard. 6: 60. 1895.

Lophianthus calycinus Micheli (as an orthographic error) in Smith, Mem. Torrey Bot. Club 5: 25. 1894.

Lophotocarpus californicus J. G. Smith, Rep. Mo. Bot. Gard. 11: 146. 1899.

These studies have been made largely in the field and rest upon observations of living plants as they vary locally and geographically and as they vary with the progression of the season. Herbarium studies were utilized to vouchsafe the nomenclature and to arrive at an understanding of the concepts expressed in the previous literature based upon herbarium material. To document our facts the following California collections have been deposited in the Herbarium of the University of California at Berkeley:

Sagittaria calycina Engelm. Lassen County: State Fish and Game nesting area, west side of section 19, Madeline Plains, 1 August 1947, *Grant & Schneider 8222;* Colusa County: pond on Colusa-Marysville Highway, 4 miles south of Colusa, 6 August 1946, *Mason & Grant 12961;* 8 miles north of Colusa, 7 August 1946, *Mason & Grant 12981;* Sutter County: rice fields, Sutter By-pass, just south of Marysville, 29 July 1949, *Nobs & Smith 1100;* Sacramento County: irrigation ditch west of Rio Linda, 15 August 1946, *Mason & Grant 13007;* San Joaquin County: Daggett Road and Borden Highway, 12 September 1946, *Mason 13126;* between Banta and Stockton, 21 August 1946, *Mason & Grant 13057;* irrigation canal ¼ mile west of Stockton, 25 September 1948, *Nobs 692;* Merced County: alkaline stream 5 miles north of Volta, 29 June 1948, *Mason 13579;* 2 miles north of Volta, 6 July 1948, *Nobs & Smith 6;* vernal pool at north end of Los Banos Wildlife Refuge, 2 miles north of Los Banos, 9 July 1948, *Nobs & Smith 67;* ¼ mile south of Ingomar, 27 July 1948, *Mason & Smith 8217;* Crane Ranch, south of junction of Merced and San Joaquin rivers, 11 August 1948, *Mason & Smith 8322.*

Sagittaria Sanfordii Greene. Butte County: West Gridley road one mile west of Gridley, Pennington highway, 8 August 1946, *Mason & Grant 13001;* road between Gridley and Princeton, 4 September 1946, *Mason & Grant 13112;* Merced County: Los Banos Wildlife Refuge, 2 miles north of Los Banos, 19 July 1948, *Nobs & Smith 169;* Modesto Gun Club, 1 mile east of

Gustine, 24 August 1948, *Nobs & Smith 429;* Highway 33, 2.4 miles north of Dos Palos, 13 July 1949, *Nobs & Smith 965;* Mendota Pool, at entrance of Firebaugh canal, 10 August 1948, *Mason & Smith 8318;* Crane Ranch, south of junction of Merced and San Joaquin rivers, 11 August 1948, *Mason & Smith 8320;* Snelling highway, 2 miles northeast of Merced, 19 August 1948, *Mason & Smith 8366.*

It is a pleasure to acknowledge the field assistance of Dr. Verne Grant, Mr. Irving Schneider, Mr. Malcolm Nobs, and Mr. S. Galen Smith. The illustrations are from the skillful hand of Mary Barnas.

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MR. PINCE'S MEXICAN PINE

N. T. Mirov[1]

That's what Gordon (1858) called *Pinus Pinceana,* a rare Mexican pine of the pinyon group. It was originally discovered by M. Ghiesbreght "near the Hacienda del Potrees (?) in the ravine of Mestitlan [Barranca de Meztitlan?], State of Hidalgo." Ghiesbreght's specimen (no. 34) to which Gordon refers in his original description is in the Mexican collection at Paris, but has never been identified and named (Shaw, 1905). Martinez (1948) says that he could not verify this find-

[1] Plant Physiologist, at Institute of Forest Genetics, California Forest and Range Experiment Station, which is maintained by the Forest Service, U.S. Department of Agriculture, in cooperation with the University of California, Berkeley, California.

ing because of the deforestation of the area. Martinez also discredited Gordon's mentioning that this pine was collected by Mr. Charles Ehrenberg "upon a mountain . . . at a place called Cuernavaca [i.e., in the State of Morelos] at an elevation of from 8000 to 9000 feet." This may have been an error on Gordon's or on Ehrenberg's part.

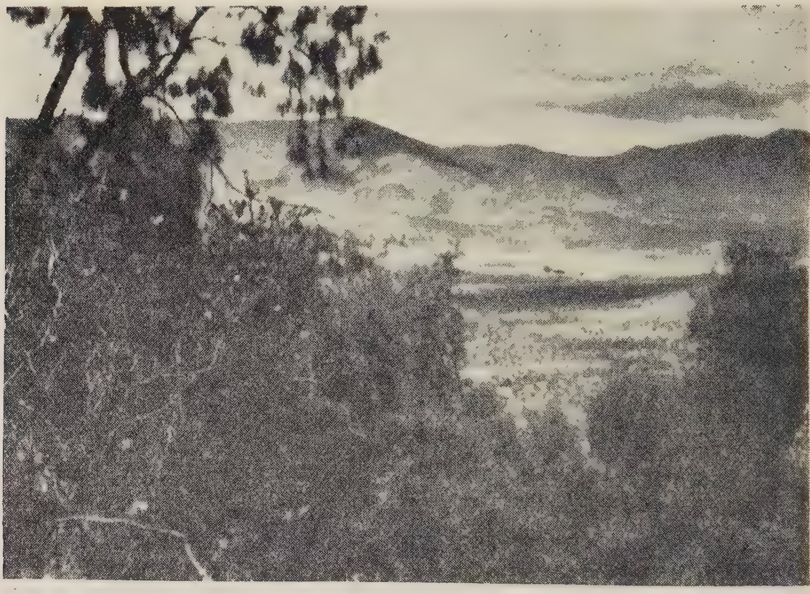
Palmer collected this pine at Carneros (i.e. sheep) Pass in 1880. According to Shaw (1905) the cones of the pine somehow became placed together with the foliage of another pine, and the whole was duly described as *Pinus latisquama* Engelm. Later Pringle collected the pine at the same Carneros Pass and Shaw himself found a few trees at this locality in 1904, "about 2 miles NW of the station." The Carneros locality probably was visited by so many botanists because, being located on the main railroad line from Saltillo to San Luis Potosí, it was rather easy to reach in those days when roads were poor. Later, *P. Pinceana* was shown to occur in other localities of southeastern Coahuila (Johnston, 1943).

Martinez mentioned the occurrence of *Pinus Pinceana* in one locality in the State of Querétaro (Rancho de El Maguey Verde, near Camargo, *G. Aguilar*) and one locality, in Hidalgo (La Mesa, *Pringle 2293*). Martinez did not see the latter specimen.

The remaining eight localities listed by Martinez were all in eastern Coahuila, chiefly in different ranges of the Sierra Parras, which extends from east to west between the deserts of Coahuila and Zacatecas. Martinez does not think that *Pinus Pinceana* occurs in Zacatecas although there are, to quote Martinez (1948, p. 99) in "el Herbario de Washington ejemplares que se dice fueron collectados en el Pico de Teyra y en la Sierra de Zuloaga, Zac." To sum up, apparently *Pinus Pinceana* occurs in a few scattered localities of southeastern Coahuila, possibly in adjacent parts of Nuevo Leon, and perhaps (subject to verification) in Querétaro.

The writer had an opportunity to see this rare pine in the summer of 1950 in the State of Coahuila at Sierra del Garambullo near Hacienda del Garambullo (not far from the station El Fraile of the Coahuila and Zacatecas Railroad). Going from Saltillo to the Hacienda de Garambullo, the writer observed this pine on Carneros Pass and near El Fraile, and studied it more closely near the settlement of Garambullo at an elevation of 7,000 to 7,500 feet. All these three localities are listed in Martinez' book.

Near Garambullo, as well as in the two other localities, *Pinus Pinceana* (locally known as *pino blanco*, which may be interpreted as light, or sparse, foliage pine) grows in rocky gulches or draws where water may rush during the summer thunderstorms, but which are generally very dry. It is not "associated with *Pinus cembroides*" as Shaw (1914, p. 40)



U.S. Forest Service Photo

FIG. 1. Hacienda Garambullo, Coahuila. Pendant branches of *Pinus Pinceana* in left foreground.

suggests. The latter pine, which is called by the local people *pino prieto* (i.e. a pine with dark or dense foliage) does occur near Garambullo but it grows in small clusters on the rounded tops and on the upper slopes of the mountains, and was not observed in the draws.

Pinus Pinceana is not a bushy tree (cf. Shaw, 1914, p. 40), neither is it as tall as Gordon says. The trees observed were twenty to thirty feet high, rather crooked and distorted, with a rough grayish bark and shiny light brown cones about three inches long and one and one-half to two inches wide. Seeds are wingless, one-half inch long and three-eighths inch wide, and of a dark brown color. The seed shell is about one-sixteenth inch thick and very hard.

The trees have the appearance, as Gordon says, of a weeping willow although to the writer they looked from a distance more like the pepper tree *(Schinus molle)*. Their long and slender but not brittle branchlets are very different from most pine branchlets, and in their graceful beauty they have only one rival among the Mexican pines—the Lumholtz pine, commonly called *pino triste* or sad pine.

Pinus Pinceana grows in association with *Rhus* and *Cercocarpus* shrubs, barrel cactus, scrub oak and occasional tall yuccas whose leaves are closely clipped by hat-makers.

The foreman of the hacienda, who is an old man, told us that although he had twice sent foliage and cones to Mexico City, he did not remember any botanist having collected Pince's pine in the locality. Dr. Elbert L. Little Jr., Dendrologist of the United States Forest Service, wrote to the author that there are no pictures in botanical publications that would show *P. Pinceana* in its native habitat. Also, there are no pictures of this pine in the extensive photographic collection of the United States Forest Service. Hence, the photograph accompanying this article may be the first published picture showing this rare pine in its natural environment.

In conclusion, it may be appropriate to mention that the chemical composition of *Pinus Pinceana* turpentine (just determined by the author of this article) differs considerably from that of the turpentine of the *Pinus cembroides* complex, in that *Pinus Pinceana* turpentine consists largely of limonene with some carene and alpha-pinene, and an unknown sesquiterpene, while the pines of the *P. cembroides* complex possess turpentines consisting mostly of alpha-pinene with some limonene, and whose sesquiterpene fraction consists either of cadinene (in American pinyons) or of longifolene (in the Mexican pinyon). Thus, biochemically *Pinus Pinceana* is situated between the pinyons and the rest of the genus *Pinus*.

As Dr. Martinez showed diagrammatically in his book (1948, p. 87) *Pinus Pinceana* and perhaps *P. Nelsoni* may be considered as connecting links between the *Pinus cembroides* complex and the rest of the genus. This writer's study of the chemical composition of *Pinus Pinceana* turpentine supports this conclusion.

The writer wishes to express his appreciation to the Associates in Tropical Biogeography at the University of California for assistance in studying the native pines of Mexico, one of which was Pince's pine.

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NOTES ON VAUCHERIA LONGICAULIS HOPPAUGH

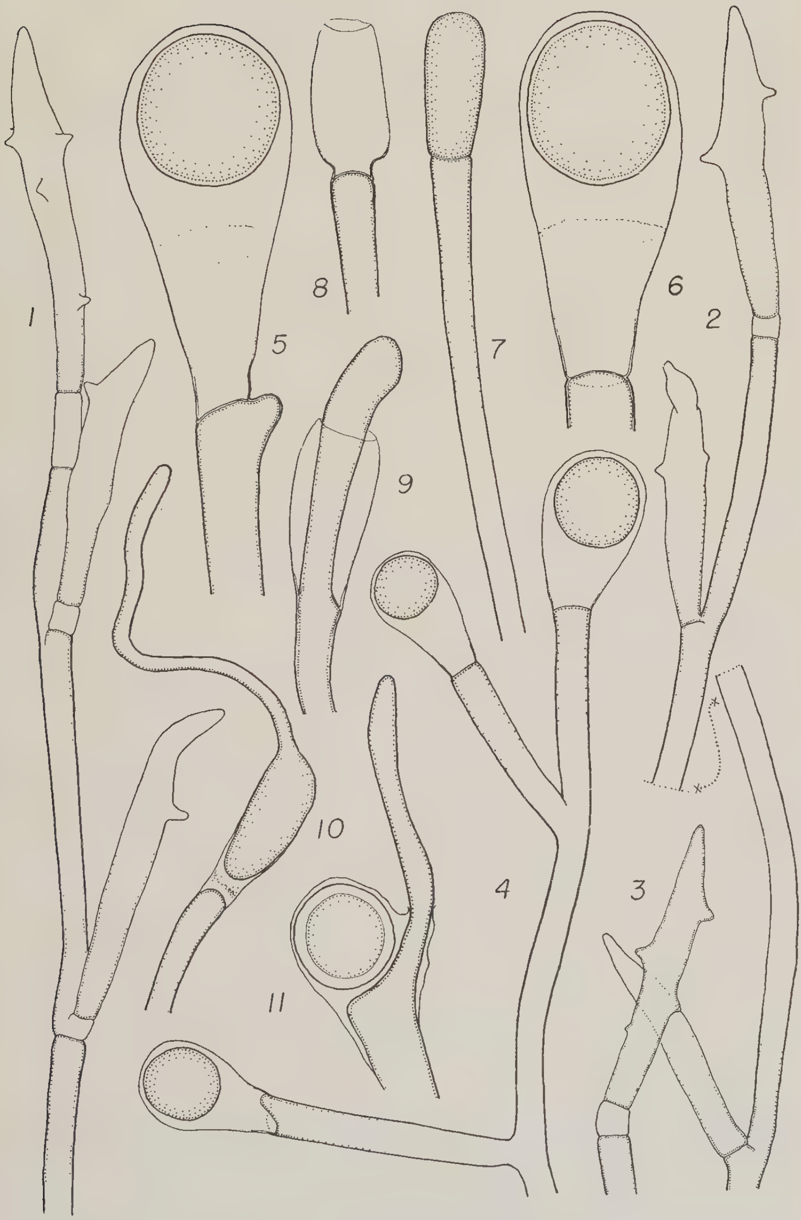
WM. RANDOLPH TAYLOR

In 1930 Dr. K. M. Hoppaugh described a large species of *Vaucheria* from Elkhorn Slough in Monterey County, California, as *V. longicaulis,* and treated it as a member of the Piloboloideae most closely related to *V. litorea* C. Agardh. The present writer, needing material for comparison with Bermudian species in the same section of *Vaucheria,* asked Professor George J. Hollenberg of Redlands University to collect specimens from the type locality, which he most kindly did in the summer of 1951. The plant is reported as essentially marine, growing partly embedded in a very muddy bank which is exposed by the considerable tidal flow at low water, and probably receives little river water in the summer. The original description is brief and lacks some important details, such as the oospore dimensions; Dawson (1946) accepts only *V. litorea* as found in marine locations on the west coast. The following notes are offered as supplementary to the type description and as confirmatory of the distinctive character of the species.

The filaments of this plant seem rather loosely associated, not matted, sparingly branched and generally 45–72 microns in diameter, somewhat thicker than the 33–60 microns of the original description. Sporangia are present, presumably aplanosporangia, since such rather than zoosporangia are reported in this section of the genus. They terminate straight branches which increase in diameter very gently for a long distance below the tip, where transverse walls isolate the cylindrical to obovoid spores (fig. 7), which are generally liberated by dissolution of the distal sporangium wall (fig. 10). In one instance the filament proliferated through the sporangium wall (fig. 9). No considerable number of sporangial measurements was made, but it was evident that they were smaller than the oogonia, reaching about 90–120 microns in diameter, and 225 microns in length. None was seen with a thick spore wall.

The sexual filaments are dioecious, as originally described. The antheridia are formed terminally and laterally in small series (figs. 1, 2) and are usually but not always separated from the filament by hyaline supporting cells, which are absent from the two lower antheridia in figure 2, but present below the terminal one. They approximate the diameter of the fila-

FIGS. 1-11. *Vaucheria longicaulis*: *1, 2,* terminal portions of male filaments, the antheridia showing various numbers of discharge papillae × 73; *3*, a single antheridium × 73; *4*, terminal portion of a branched female filament showing three oogonia × 73; *5, 6,* oogonia with mature oospores × 147; *7*, young sporangium terminating a filament × 92; *8*, empty sporangium × 92; *9*, proliferation of a filament through the base of an empty sporangium × 92; *10*, germination of an aplanospore *in situ* × 73; *11*, proliferation of a filament through the base and side of an abnormal oogonium × 110.



FIGS. 1-11. *Vaucheria longicaulis.*

ment and vary from half to three times this in length. The antheridia are spindle-shaped, usually largest at the middle or a little above, in diameter 60–90 microns, averaging 78 microns exclusive of the papillae, and in length 450–680 microns, averaging 551 microns, thus much wider than cited by Hoppaugh (45–60 microns), whose maximum is no greater than the filament diameter she describes. Those in our plants always exceeded the diameter of the supporting filament. The discharge papillae are conical, not as tubular as in some Piloboloideae, and in number rather less than she cited, usually three or four.

The oogonia are terminal on leading axes, or at the end of lateral branches about twice the length of the oogonia. They quickly become pyriform (figs. 4–7), and the sharp expansion toward the distal end makes it easy to distinguish them from sporangial rudiments when young. In no instance was a special basal cell seen, nor were the rather long branches bearing the oogonia at all recurved. These were the chief characters offered by Hoppaugh to separate *V. longicaulis* from *V. litorea*, and they seem quite constant. Our measurements give the range in length as 242–430 microns and the average as 360 microns, the width as 140–200 microns and the average as 160 microns; this agrees well with her figures for length of 275–440 microns, but our average width is much over her mean of 137 microns. There frequently may be seen a scar, part way up the empty oogonium, similar to that noted by the writer in other Piloboloidae (figs. 5, 6). The distal fertilization pore does not remain distinct. The oospore protoplast withdraws completely from the oogonial wall and forms its own spore wall free from the sac. The spores have firm but rather thin brown walls, and may be either spherical or slightly oval. They are quite free from the oogonial wall (figs. 5, 6), though they sometimes touch it. This is in contrast to the condition in *V. piloboloides*. The width varies from 115–165 microns, the average being 141 microns, the length 130–200 microns, the average 163 microns. Dr. Hoppaugh did not consider the oospore dimensions reliable and gave no measurements, but the writer found them as good as any other measurements. Occasionally a very thick colorless refractive wall was seen, reaching 11–15 microns in thickness, but this seemed abnormal (fig. 11). The example drawn also happened to show a proliferation of the filament into the oogonium through the base, and out the side.

Whereas the absence of the special supporting cells and straight rather than recurved oogonial branches suffice to distinguish *V. longicaulis* from *V. litorea*, we may also note that there are size differences between respective organs of these species. These generalities are based on an inspection of a number of references to *V. litorea* (Brown 1929, Collins 1909, DeToni 1889, Farlow 1881, Hamel 1930–31) although when one

compares individual descriptions of *V. litorea* with each other one finds considerable variation. The most marked disagreement comes with the description and figure given by Newton (1931, p. 104, fig. 68B–D), whose cited dimensions for the antheridia of 55–65 microns would make them slenderer than the filaments, given as 70–95 microns, although she figures them as wider. Perhaps her description "oogonium almost spherical, 190–450 microns in diam." refers to the oospore, since she figures the oogonium as a clavate structure (fig. 68D), though one must observe that 450 microns is unexpectedly long, even for the longer diameter of these oospores, more in line with the longer dimensions given for oogonia (DeToni 1889). However, we may accept it that the filaments and the antheridia of *V. litorea* are in general distinctively more slender than in *V. longicaulis*, the oogonia are not very different in size, but the oospores are considerably smaller.

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CAREX DIVERSISTYLIS, A NEW SPECIES FROM OREGON

Archibald W. Roach

Carex diversistylis sp. nov. Caules quam folia breviores glabri ca. 10 cm. alti e rhizomatibus brevibus. Paginae foliorum 1.5 — 2.5 mm. latae. Spicae masculae solitariae 7 — 9 mm. longae 1.5 mm. latae; spicae feminae 2 — 4 infimae folio suffultae; flosculis 4 — 8; perigynia 2 — 3 mm. longa valde stipitata pubescentia orbiculata elliptica bicarinata ceterum enervata rostro abrupto 1 mm. longo apice vix bidentato;

styli 2 — 3 (plerumque 3) in eadem spica; squamae ovatae acuminatae vel acutae.

Low cespitose mats from short rootstocks; the culms ranging from very short to 10 cm. high, shorter than the leaves, very slender, smooth. Leaf blades light green, 1.5 — 2.5 mm. wide, slightly roughened towards apex, basal sheaths dark red, nerves scabrous; bract of lowest non-basal pistillate spike leaf-like, exceeding culm, slightly brown-tinged at base. Staminate spike solitary, 7 — 9 mm. long, 1 — 1.5 mm. wide; pistillate spikes 2 — 4, usually 4 — 8 flowered, upper 1 — 2 approximate, short-pedicellate, lowest basal spike on a filiform peduncle subtended by a leaf; perigynia 2 — 3 mm. long, strongly stipitate, pubescent, 2-keeled but otherwise nerveless, body more-or-less terete, elliptic, abruptly narrowed to a beak 1 mm. long, one-third as long as the body, apex scarcely bidentate, styles 2 or 3, mostly 3, in same spike; scales ovate, acuminate or acute, light green or with chestnut submarginal stripes, midnerve green often scabrous towards apex.

Type. Among interstices of basalt blocks one-quarter mile north of Clear Lake Junction on U.S. Highway 20, Linn County, Oregon, *A. W. Roach 202*, June 10, 1949 (Oregon State College Herbarium).

Carex brevipes W. Boott and *C. Rossii* Boott are close relatives of *C. diversistylis*. In detailed comparative charts of characteristics, the latter differs from both chiefly in a diversity of style number and an absence of culm scabrousness. In the section *Montanae* of the floras of Abrams (1940, p. 286), Mackenzie (1940, pl. 229), and Peck (1941, p. 163), this entity runs to *C. brevipes* since its perigynia are of the same length and its beaks are shallowly bidentate. Yet its culms are shorter than the leaves, the staminate spikes are smaller, the pistillate spikes are much fewer-flowered, and the perigynial beaks are chestnut-striped. And though these characters are typical of *C. Rossii*, *C. Rossii* has larger, more pubescent perigynia whose beaks are more deeply bidentate. Other sources (Fernald 1950; Small 1933; Marie-Victorin 1947) failed to reveal other species of close affinity.

The occurrence of 2 or 3 styled gynoecia in the same spike is of particular interest in that it is rare for this genus. However, one other species, the trigonous *C. novae-angliae* Schwein., which occurs in this tribe, shows diversistyly (Marie-Victorin 1947, p. 725).

The complete range of the new species is not known. The type material was secured during the compilation of floristic lists for a phytosociologic analysis of the associations of the Nash Crater lava flows (Roach, 1950). This area, roughly ten square miles in extent, is the northern end of a recent magmatic chain (490 years old) which extends from

the Santiam region south to the McKenzie-Three Sisters region. Since this species is wide-spread in scattered mats over the barer basalts in association with *Juncus Parryi* Engelm. and *Penstemon Menziesii* var. *Davidsonii* (Greene) Piper, and in view of its communal-edaphic amplitudes it seems possible that this species is co-extensive with the whole more-or-less homogeneous chain of basalts.

Grateful appreciation is acknowledged Dr. H. M. Gilkey, Curator of the Oregon State College Herbarium who confirmed the style diversity in the fresh material and later checked the work on this species; Miss D. Babb, North Texas State College, who criticized the Latin context; and Mrs. R. S. Ferris, Assistant Curator of the Dudley Herbarium, who loaned authoritative specimens.

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REVIEWS

Handbook of North Dakota Plants. By Orin Alva Stevens. The North Dakota Institute for Regional Studies, North Dakota Agricultural College, Fargo, North Dakota. 324 pp., frontispiece, figures 1–319. 1950. $4.50.

The Handbook of North Dakota Plants satisfies a long-felt need for a comprehensive manual on the Flora of North Dakota. It is limited to plants known to occur in the State as native or introduced species which are growing in the wild. Although the Handbook is based primarily on botanical collections beginning in 1890 with the establishment of the North Dakota Agricultural College, it has drawn heavily upon the careful field and herbarium studies of the North Dakota flora made by Dr. Stevens over a period of forty years. This is reflected in the brief but very useful and pertinent comments on various species. Aside from the usual technical descriptions, the volume contains much useful information on the ecology,

distribution, poisonous properties, food value, and other noteworthy items not usually referred to in botanical manuals.

The Handbook includes a brief history of early botanical explorations in North Dakota. Also included under general information are maps of the State showing the counties and principal cities, the chief physical features, and sixteen outline maps of the State showing typical plant associations and species distributions.

The author has treated species and species names conservatively. For example, all of the genus *Amelanchier* is included under the single species, *A. alnifolia* Nutt., even though other authorities at times have described North Dakota material under several additional species names. In cases of this type, where the author has had a wide personal field acquaintance with the native material and could not establish the presence of fundamental taxonomic differences, he has generally avoided the separation into additional species.

The figures are of excellent quality and were largely photographed, or, in the case of line drawings, drawn specifically to serve a certain purpose in the Handbook. The binding, paper, and printing are of good quality, and the text is quite free of typographical errors. It includes descriptions of 1143 species and 102 families.

The student and teacher will find informative suggestions on the use of keys. The general key to families is supplemented with 82 carefully chosen line drawings that are printed in the margin of the key. Due to the limited number of genera, the keys to the species usually follow the general description of the family. A single key may be used for the genera and species in a family, especially if the genera include only a few species. This may result in slight confusion to those who are accustomed to having separate keys for genera and species.

The Handbook is intended for use in studying a rather limited flora which includes part of the transition zone between the eastern woodland flora and the grassland flora of the Plains. Within its proper range it is an exceptionally useful volume to the amateur and professional alike. JOSEPH H. SCHULTZ, Department of Horticulture, North Dakota Agricultural College, Fargo, North Dakota.

Flora of the Charleston Mountains, Clark County, Nevada. By IRA W. CLOKEY. University of California Publications in Botany, vol. 24, vi + 274 pp., map. 1951. University of California Press, Berkeley and Los Angeles. $2.75 (paper), $3.75 (cloth).

Intensive study of the vegetation of restricted areas is a phase of botanical activity too often neglected. Concentration on a limited field enables an observer to acquire a deeper and more accurate view of the variability, ecological requirements,

relative abundance and seasonal behavior of his species than is otherwise possible. It is upon such observation, especially when backed up, as in this case, by an exceptionally ample and widely distributed herbarium record, that a picture of larger and more natural floristic regions can be built up. In this respect, apart from its intrinsic merit, the Flora of the Charleston Mountains will be welcomed and valued as an important step towards an understanding of the Intermountain and Desert floras, inasmuch as the range lies at or near the point where the Mojavean and Great Basin floras meet and overlap.

The Charleston Mountains, as delimited for the purpose of the Flora, cover an area estimated at some 650 square miles lying just west of the California line in Clark County, Nevada, and extend from the base of the foothills at about 1000 meters to the summit peak at 3630 meters. The periphery is and can be only vaguely defined, but it embraces the alluvial fans enclosed by outlying spurs, while the adjacent valley-floors (and thereby such species as *Arctomecon californica, Phacelia Parishii,* etc.) are excluded. It should be noted that the otherwise serviceable map is not exactly coextensive with the area covered, Indian Springs, for example, repeatedly mentioned in the text and an important type-locality, lying beyond its northeastern limit. The broken nature of the terrain, especially of the abrupt eastern escarpment, with its hot desert valleys, cliffs, box-canyons and, upward, the cooler but still largely arid pine-forests, aspen-groves and finally a small area above timber-line, provides a great variety of habitats, and the flora is rich and remarkable. Clokey enumerates 699 ferns and seed-plants from the Charlestons, and states his belief that the list is at least 80 per cent complete. This strikes the reviewer as a modest estimate. Certainly we may expect here several species known from a few miles outside the limits of the Flora (such as *Selinocarpus diffusus, Mortonia utahensis, Astragalus sabulonum, Coldenia Nuttallii, Nama pusillum, Salvia mohavensis,* to name a few), some that occur on both sides of the range *(Phacelia geraniifolia)* and others new or surprising, but hardly so great an increase as 20 per cent (between 80 and 90). The number is in any case impressive. No comparable figure for a range in the interior is available, but we may contrast it with the 761 taxa, as given by Sharsmith (Am. Midl. Nat. 34:289–367. 1945), in the Mount Hamilton Range in California, an area twice as great though physiographically less varied. Special interest attaches to the large endemic element of 31 taxa (or about 4.5 per cent), some of them taxonomically isolated, though we may expect this total to be somewhat reduced as the calcareous mountains of central Nevada become better known.

The plan of the Flora follows closely that adopted by Kearney and Peebles for their Flowering Plants and Ferns of

Arizona, a model hardly to be improved upon where space forbids individual specific descriptions. The main body of the work consists of an annotated list, with excellent keys to the families, genera, and, when more than one, to the species. Each genus is described briefly, and under the specific heading, following a rather full synonymy and quotation of type-locality, all known collections of the species from the Charlestons are recorded, with a general statement of its frequency there, its altitudinal limits, extralimital range, and other pertinent data. Note is taken in each case of the species' association with one or more of eleven woody plants used as zonal indicators, the Merriam life-zones being too feebly or erratically expressed to be of much service in the Charleston Mountains. The principal indicators are creosote-bush, sagebrush, Utah juniper, pinyon, and the yellow, limber and bristlecone pines. Although the Peak rises beyond the limit of trees, there is no truly alpine flora.

The descriptive text is preceded by a short but informative outline of the region's geological history (contributed by Chester R. Longwell), forming a background against which the diverse origins of the vegetation can be to some measure understood. Concise notes on the physiography of the area, the climate, and a highly interesting list of the strictly endemic and near-endemic species are provided. The entire flora and the endemic element are analysed according to the approximate zone of occurrence and their floristic relationships, and it is brought out that middle elevations in the Charlestons, corresponding roughly with the pinyon-juniper and yellow-pine forests, are richest by far in number of species, while the relationship of the majority is with the Great Basin, broadly interpreted. However, far northern, Mexican, Rocky Mountain and Sierran elements are more or less strongly represented, and it becomes clear that the Charleston Mountains have provided both a sanctuary for the preservation of relics from floras once more widespread and, by reason of their long isolation, a theatre for the evolution of new forms. This combination makes the region of the highest interest to phytogeographers.

During the preparation of the Flora, Clokey corresponded widely with fellow-botanists, seeking advice and determinations from specialists wherever possible. The treatments of several families or genera were contributed by acknowledged authorities, and no effort was spared to bring the nomenclature into line with the best current usage. This is no mere compilation, however. Each determination by others passed before the keen and sceptical scrutiny of the author, and his personal viewpoint is vigorously stated in discussion of particular problems of identity or taxonomic status. The conservative view of the species is uniformly that of Clokey himself. Many groups

were, of course, worked up by the author himself, as attested by a series of six preliminary papers published, largely in this journal, between 1937 and 1945. These stand as evidence of the sound original research on which the Flora is based.

The Flora of the Charleston Mountains appeared posthumously under the able editorial guidance of botanists at the University of California, Berkeley, where the Clokey Herbarium, upon which the work so largely rests, is housed. We cannot but regret that the author did not live to experience the pleasure of turning the pages of this handsome volume upon which he worked long and arduously in the face of failing health, and upon the publication of which, as the principal achievement of a lifetime devoted to botany, he placed great store. We can be sure, however, that this work, a significant advance in the documentation of the western flora, will prove an enduring memorial to the labors of a gifted botanist. RUPERT C. BARNEBY, Wappingers Falls, New York.

NOTES AND NEWS

JEFFREY PINE IN THE SOUTH COAST RANGES OF CALIFORNIA. Jeffrey pine has been reported locally in California in the South Coast Ranges as far north as the mountains near San Luis Obispo, in the San Bernardino and San Jacinto mountains and southward into the San Pedro Martir Range in Baja California, Mexico. This species is most common and important in the Sierra Nevada, localized on the western slopes of the range and commonly forming pure stands on the eastern slopes. Jeffrey pine also occurs in the northern Coast Ranges, in Mendocino and Humboldt counties, usually being restricted to serpentine outcrops. Although the presence of this species here is not too well publicized, it has been mapped by members of the Forest Survey (California Forest and Range Experiment Station). Samples obtained by Paul Zinke of the Forest Survey show that Jeffrey pine from the northern Coast Range has characters similar to Jeffrey pine from other areas.

During a recent study of the natural hybrid between *P. Jeffreyi* Grev. and Balf. and *P. Coulteri* Lamb., two small populations of Jeffrey pine, totaling several hundred trees, were found on Chew's Ridge in the northern Santa Lucia Mountains in the Los Padres National Forest, Monterey County, California. These populations are at 5,000 feet elevation, on the ridge top both to the north and southwest of the Chew's Ridge lookout tower. This locality is approximately 100 miles north of the San Luis Obispo County Jeffrey pine occurrence. When the study was undertaken, Jeffrey pine was not known to occur in the Chew's Ridge region; at least, no reference could be found in the literature, and no one with whom the writer

talked was aware of its presence there. It was thought this idea was confirmed when a communication dated May 4, 1951 was received from Mr. A. R. Campbell, District Ranger of the Monterey Division of the Los Padres National Forest, which stated that Jeffrey pine had not been previously reported in this locality. However, a follow-up letter, dated October 23, 1951, stated that he had found an entry in an old diary of March 11, 1910 as follows: "Rode over Jeffrey pine plantation on Chew's Ridge—further instructions for mapping". That is all that could be found, neither maps nor further references to the plantation being located.

On the strength of the above it would seem that Jeffrey pine growing in this area is the result of plantations, and not isolated natural populations as at first suspected. However, without more investigation, neither can be proved. Mr. Campbell states that a very severe fire burned through this region in 1928. Some of the present Jeffrey pine became established about this time, while the majority are somewhat older.

Regardless of its source, the Jeffrey pine growing in this region has an exceptional growth rate and vigor; those trees measured had a mean annual diameter growth of 0.53 inches, a rate considerably in excess of that for other Jeffrey pine populations studied, whose diameter growth averaged less than 0.30 inches a year. The morphologic, anatomic and oleoresin characters are similar to those of Jeffrey pine from other areas.

In the vicinity of the one Jeffrey pine population, several small trees were studied that had characters similar to the Jeffrey-Coulter pine hybrid. All but one of these were relatively small and their presence could be explained from either the natural or plantation viewpoint of the source of this Jeffrey pine. However, one of the trees with hybrid characters was relatively large, and must have been there before the plantation establishment. Apparently Jeffrey pine is not spreading too successfully here, for the majority of reproduction in the Jeffrey populations has the characters of either Coulter pine or the Jeffrey-Coulter hybrid.

Another interesting area where Jeffrey pine is growing is in the San Carlos Range (San Benito County) east of King City in the region around New Idria. Although known to some botanists and foresters, no reference was found in the literature to Jeffrey pine growing here. The trees from this area have characters similar to other Jeffrey pines, although some variation is found due to the occasional hybridization with Coulter pine and to the presence of extreme site conditions, the area being very dry, with sandy, serpentine, alkaline soil. BRUCE ZOBEL, Texas Forest Service, College Station, Texas.